Survey of Uranium and Radon in Private Wells in Kleberg County

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Introduction

Uranium has been mined using in-situ recovery (ISR) at numerous sites in South Texas. **Figure 1** shows the location of four active mines (red triangles), 32 closed ISR mines (white circles), and two new ISR mines currently in the permitting process (blue squares). Since the major source of drinking water in the area is groundwater, communities are concerned about restoration of groundwater to baseline levels and any possible contamination of their private wells by migration of contaminants such as uranium, radium, radon, molybdenum, and others from mining sites.

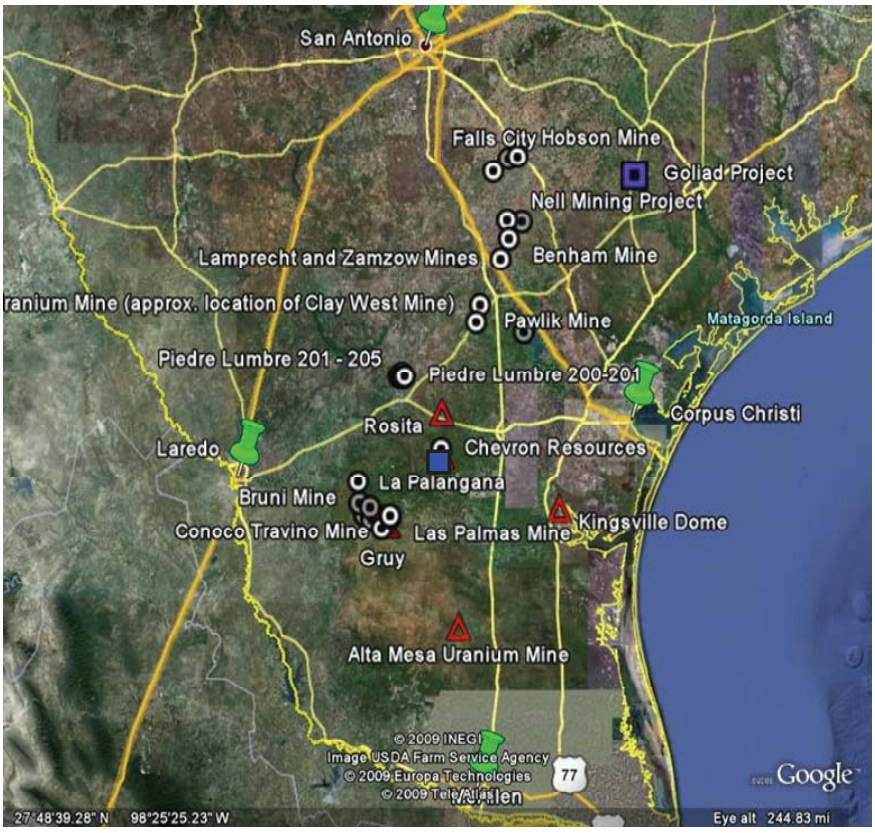

Figure 1. Locations of 38 uranium ISR mining sites in South Texas (http://www.uraniuminfo.org/).

Two cities in Kleberg County have U concentrations in their public water supplies that are above the EPA's drinking water standard and are planning to implement reverse osmosis or ion exchange treatment in the near future. In addition, a preliminary survey of 17 private wells in Kleberg County has shown that 14 (82%) had uranium concentrations greater than 7 ppb, and 3 (18%) had uranium concentrations above the EPA drinking water standard of 30 ppb, including

one with a concentration of 161 ppb. This has created public controversy as to whether the uranium is present naturally, or is rather a consequence of uranium mining activity in the area. Radioisotope transport in groundwater systems has been investigated by different researchers to determine radionuclide migration behavior (Ku *et al*., 2009), as well as the disequilibria in the uranium decay series to determine source, age and mixing of groundwater (Luo *et al*., 2000). The purpose of this research project is to survey U and Rn concentrations in groundwater from private wells in Kleberg County and to investigate the potential transport of uranium and other contaminants in groundwater from mining sites using radioisotopes in the 238U decay series (**Figure 2**).

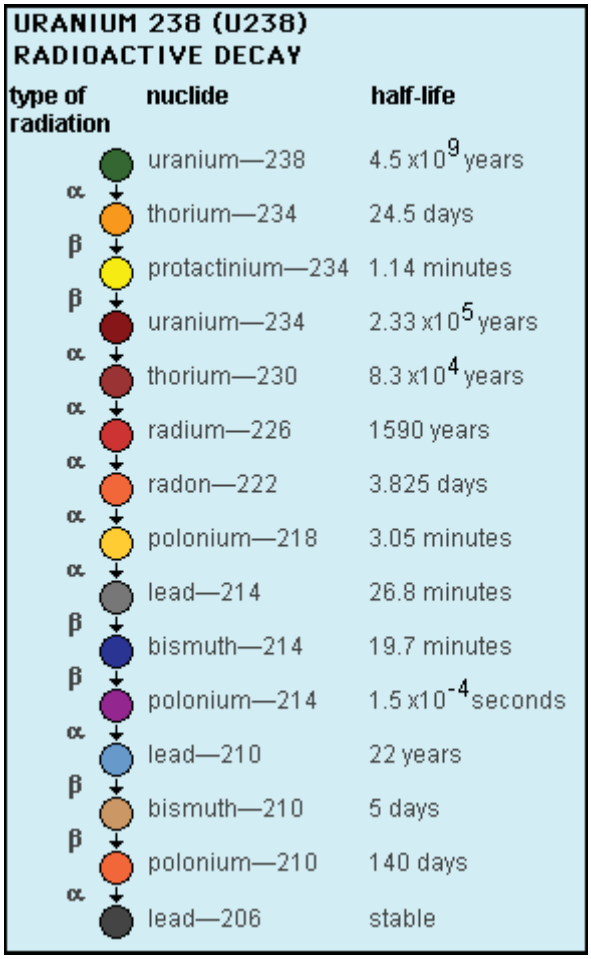

Figure 2. Radioactive Decay Uranium 238 (http://www.atral.com/U2381.html).

Research Objectives

1. Protect public health by assessing concentrations of U and Rn in drinking water.
2. Compare existing concentrations in wells that were previously surveyed during a study conducted by the USGS in the late 1970s and characterize any trends.
3. Develop hydrogeochemical forensic methods to assess whether or not U present in well samples is a result of anthropogenic activity.

Methodology

Twenty-one private drinking water wells in Kleberg County (near the Kingsville Dome uranium mining site) were sampled during spring 2010 (**Figure 3)**. Uranium concentrations were determined using ICP-MS following EPA Method 200.8, and analyses for the determination of radon were performed in the place using a RAD7 Electronic Radon Detector. **Figure 4** shows the location of the private wells.

Figure 3. Collecting water samples and performing analyses for radon and other parameters.

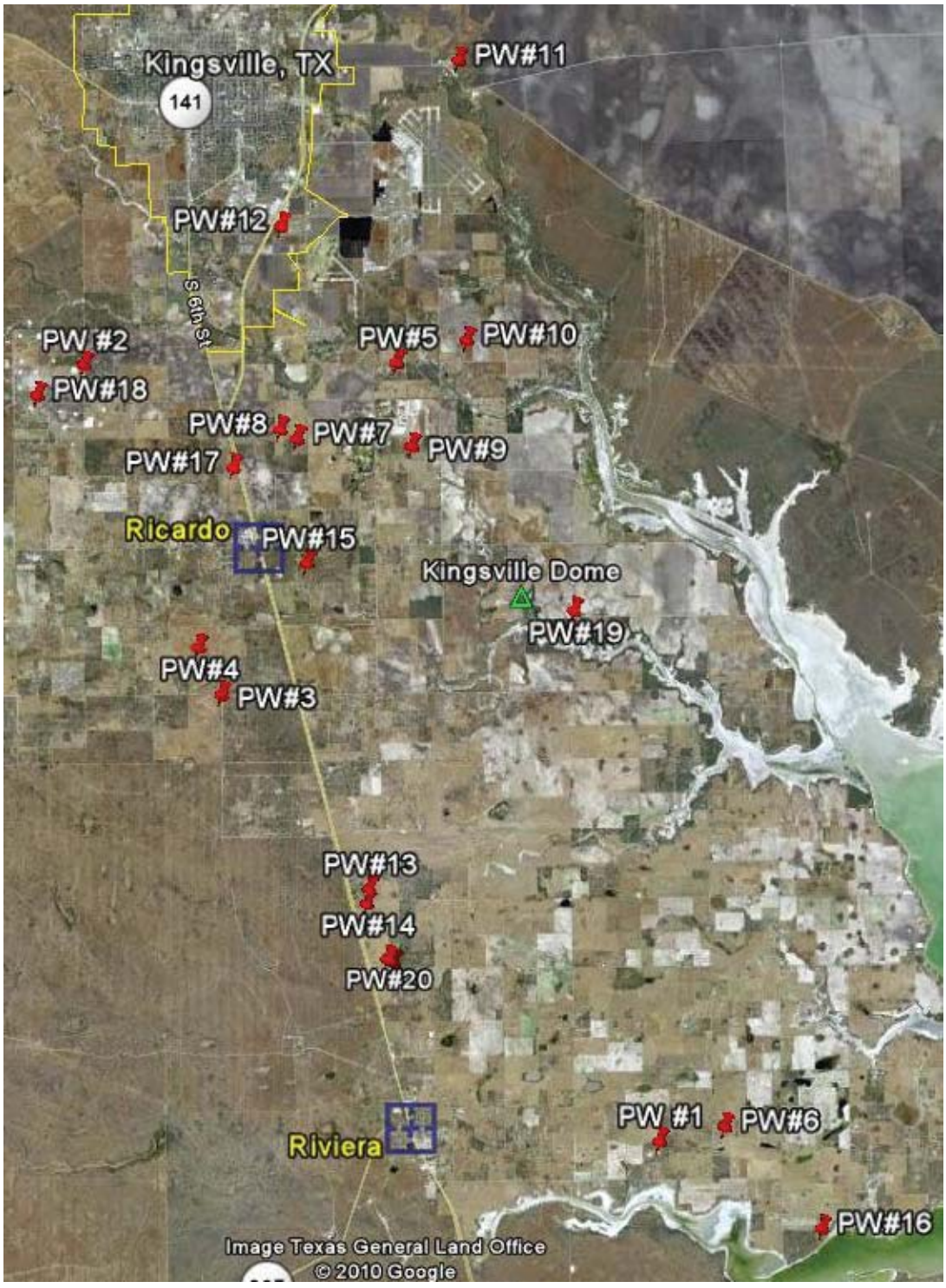

Figure 4. Locations of 20 drinking water wells tested in spring 2010 in Kleberg County.

Preliminary Results

Figure 5 shows the concentrations of uranium and radon in the different private wells. Nine wells (43%) had concentrations below 10 ppb, four wells (19%) had concentrations above the EPA drinking water standard of 30 ppb, including two with concentrations around 160 ppb and one with a concentration of 771 ppb. For radon, eleven wells (52%) had concentrations below 300 pCi/L, the rest of the wells had concentrations between 307 and 1840 pCi/L, which were below the alternative maximum contaminant level (AMCL) of 4000 pCi/L recommended by EPA. Four of the high concentrations of radon coincided with the four highest concentrations of uranium.

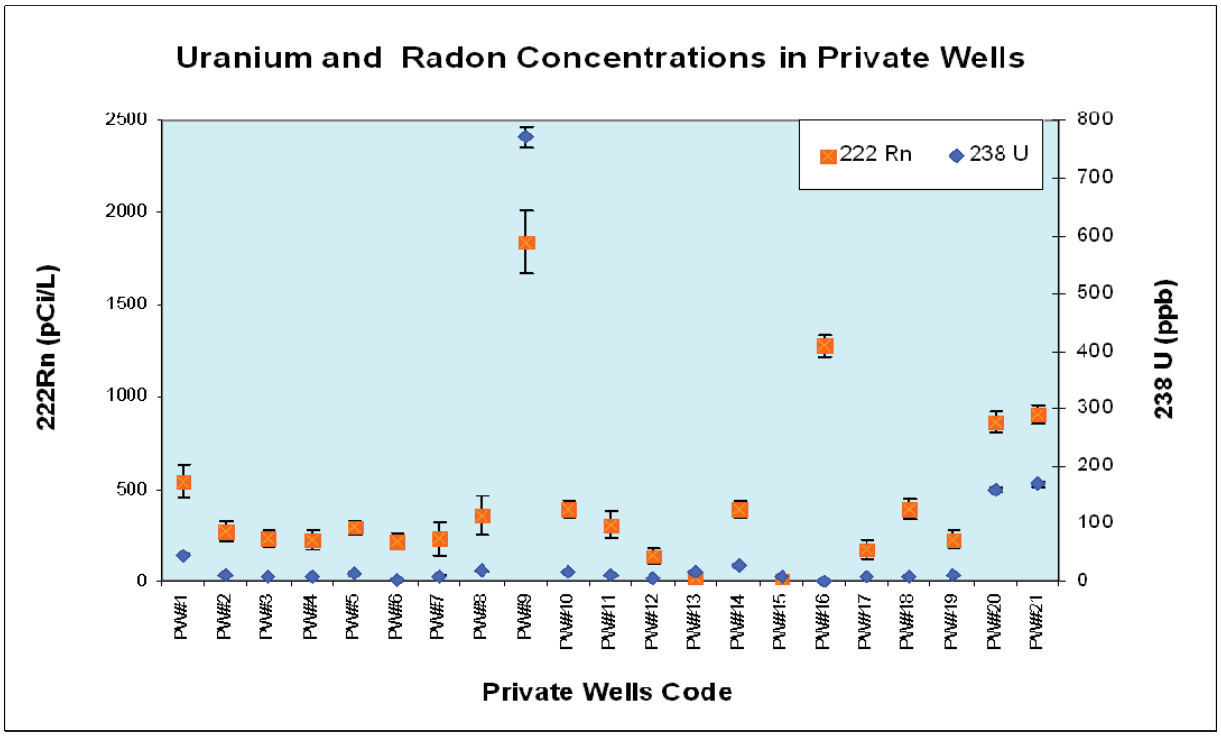

Figure 5. Concentrations of uranium and radon in privates wells (error bars represent the 95% confidence intervals).

Ongoing Research

The detection of uranium in groundwater used for drinking water in South Texas has raised significant public concern that the widespread mining operations could have caused groundwater contamination. Our research group is currently developing geochemical forensic methods for distinguishing between contamination and naturally high background concentrations. In particular, we are developing analytical methods for accurately quantifying concentration ratios of radionuclides with short and long half-lives (U238:Rn222 ratios) to distinguish between dissolved U at near-equilibrium with mineralized U and dissolved U that could potentially have been transported away from mineralized zones as a result of mining activity.

References

Ku, T.L. *et al.* (2009). Modeling non-steady state radioisotope transport in the vadose zone – A case study using uranium isotopes at Pena Blanca, Mexico. *Geochimica et Cosmochimica Acta,* 73, 6052-6064.

Luo, S. D., *et al.* (2000). In-situ radionuclide transport and preferential groundwater flows at INELL (Idaho): Decay-series disequilibrium studies. *Geochimica et Cosmochimica Acta*, 64, 867–881.

Acknowledgements

This material is based upon work supported by the Center of Research Excellence in Science and Technology – Research on Environmental Sustainability of Semi-Arid Coastal Areas (CREST-RESSACA) at Texas A&M University– Kingsville (TAMUK) through a Cooperative Agreement (No. HRD-0734850) from the National Science Foundation (NSF). Any opinions, findings and conclusions or recommendations expressed in this material are those of the authors and do not necessarily reflect the views of the National Science Foundation.